Name _____ Date _____ Class_____

Defining and Evaluating a Logarithmic Function

Practice and Problem Solving: A/B

Write each exponential equation in logarithmic form.

1. $3^7 = 2187$

2. $12^2 = 144$

3. $5^3 = 125$

_____ _____ _____

Write each logarithmic equation in exponential form.

4. $\log_{10} 100{,}000 = 5$

5. $\log_4 1024 = 5$

6. $\log_9 729 = 3$

_____ _____ _____

Evaluate each expression without using a calculator.

7. $\log 1{,}000{,}000$

8. $\log 10$

9. $\log 1$

_____ _____ _____

10. $\log_4 16$

11. $\log_8 1$

12. $\log_5 625$

_____ _____ _____
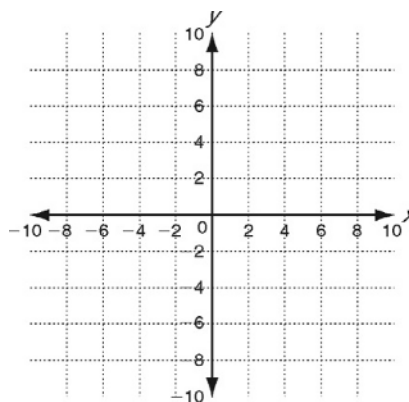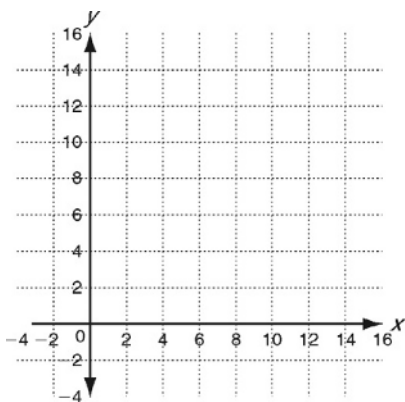
Use the given *x*-values to graph each function. Then graph its inverse. Write an equation for the inverse function and describe its domain and range.

13. $f(x) = 2^x$; $x = -2, -1, 0, 1, 2, 3, 4$

14. $f(x) = \left(\dfrac{1}{2}\right)^x$; $x = -3, -2, -1, 0, 1, 2, 3$

_____ _____

Solve.

15. The acidity level, or pH, of a liquid is given by the formula $pH = \log \dfrac{1}{[H^+]}$,

    where $[H^+]$ is the concentration (in moles per liter) of hydrogen ions in the liquid. The hydrogen ion concentration in moles per liter for a certain brand of tomato vegetable juice is 0.000316.

    a. Write a logarithmic equation for the pH of the juice. _____

    b. What is the pH of the juice? _____

Reading Strategies

1. a. Quadratic function

   b. The data set has constant second differences between *y*-values for evenly spaced *x*-values and is shaped like a parabola.

2. a. Linear function

   b. The data set has constant first differences between *y*-values for evenly spaced *x*-values and the graph is a straight line.

3. Possible answer: An exponential function because the plot appears to show curvature and the right side looks like it might have the *x*-axis as an asymptote.

Success for English Learners

1. A linear model has data that forms a straight line instead of a curve. An exponential model has a curve, but approaches an asymptote. This model appears to curve then return, in the shape of a downward opening parabola.

2. Possible answer: This regression model appears to be a fair fit, but not a very close fit. The data points appear close to the curve and on either side of it, but the points near the end are well below the curve.

MODULE 14 Challenge

1.

Square n	Grains of Wheat on Square n	Total Grains of Wheat on Board
1	1	1
2	2	3
3	4	7
4	8	15
5	16	31
6	32	63
7	64	127
8	128	255
9	256	511
10	512	1023

2. 2^{n-1}

3. $2^{63} = 9{,}223{,}372{,}036{,}854{,}775{,}808$

4. $2^n - 1$

5. $2^{64} - 1 = 18{,}446{,}744{,}073{,}709{,}551{,}615$

6. 147,573,952,589,676 kilograms

7. 254.4 years

MODULE 15 Logarithmic Functions

LESSON 15-1

Practice and Problem Solving: A/B

1. $\log_3 2187 = 7$

2. $\log_{12} 144 = 2$

3. $\log_5 125 = 3$

4. $10^5 = 100{,}000$

5. $4^5 = 1024$
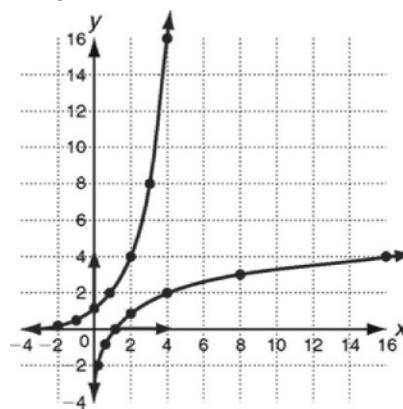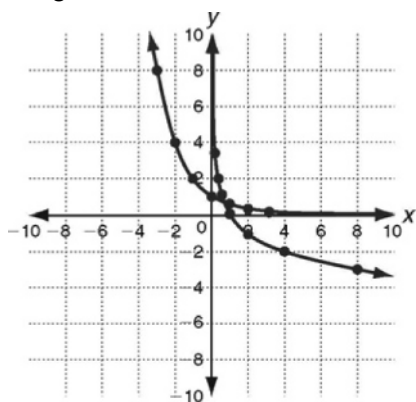
6. $9^3 = 729$

7. 6

8. 1

9. 0

10. 2

11. 0

12. 4

13. $f^{-1}(x) = \log_2(x)$; Domain: $\{x \mid x > 0\}$; range: all real numbers

14. $f^{-1}(x) = \log_{\frac{1}{2}}(x)$; Domain: $\{x \mid x > 0\}$;

    range: all real numbers

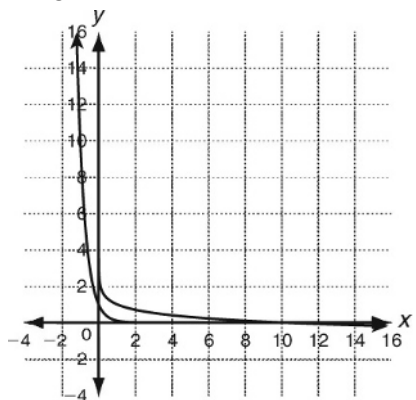15. a. $pH = \log \dfrac{1}{0.000316}$

    b. 3.5

Practice and Problem Solving: C

1. $\log_{20} 8000 = 3$

2. $\log_{11} 14{,}641 = 4$

3. $\log_a c = b$

4. $10^7 = 10{,}000{,}000$

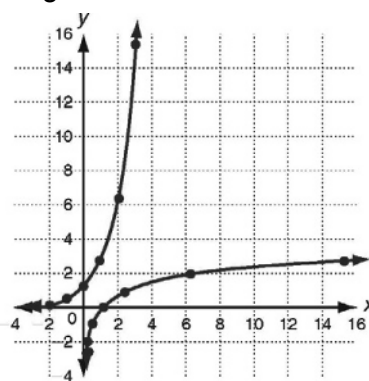5. $6^3 = 216$

6. $p^r = q$

7. 0

8. 4

9. 3

10. 5

11. 0

12. 4

13. $f^{-1}(x) = \log_{0.1}(x)$; Domain: $\{x \mid x > 0\}$;

    range: all real numbers

14. $f^{-1}(x) = \log_{\frac{5}{2}}(x)$; Domain: $\{x \mid x > 0\}$;

    range: all real numbers

15. a. $pH = \log \dfrac{1}{0.00794}$

    b. 2.1

Practice and Problem Solving: Modified

1. 3

2. 6

3. 2

4. $\log_2 8 = 3$

5. $\log_{17} 1 = 0$

6. $\log_2 \dfrac{1}{8} = 3$

7. $\log_4 1024 = 5$

8. $\log_3 729 = 6$

9. $\log_5 625 = 4$

10. 4^3

11. 8^3

12. 6^2

13. $10^2 = 100$

14. $5^3 = 125$

15. $9^0 = 1$

16. $2^7 = 128$

17. $3^5 = 243$

18. $100^3 = 1{,}000{,}000$

19. 4

20. 5

21. 0

22. $x = 4$

23. $x = 0$